NUCLEAR BLAST

OVERVIEW

The Overview section defines the hazard and summarizes the hazard risk profile.

Definition

This section defines the scope of the hazard category. The terminology and characterization established in this section should be consistent throughout all Howard County planning documents.

A **Nuclear Blast** is the result of a device that uses a nuclear reaction to create an explosion far more powerful than that of conventional explosives.[1] When nuclear weapons or improvised nuclear devices (INDs) explode, they give off energy in the form of a blast wave, intense light, heat, and radiation.

Risk Profile

The Risk Profile section presents the Risk Score for the hazard in a range from 1 (lowest risk) to 4 (highest risk). Risk Score is a function of Likelihood and Consequence.

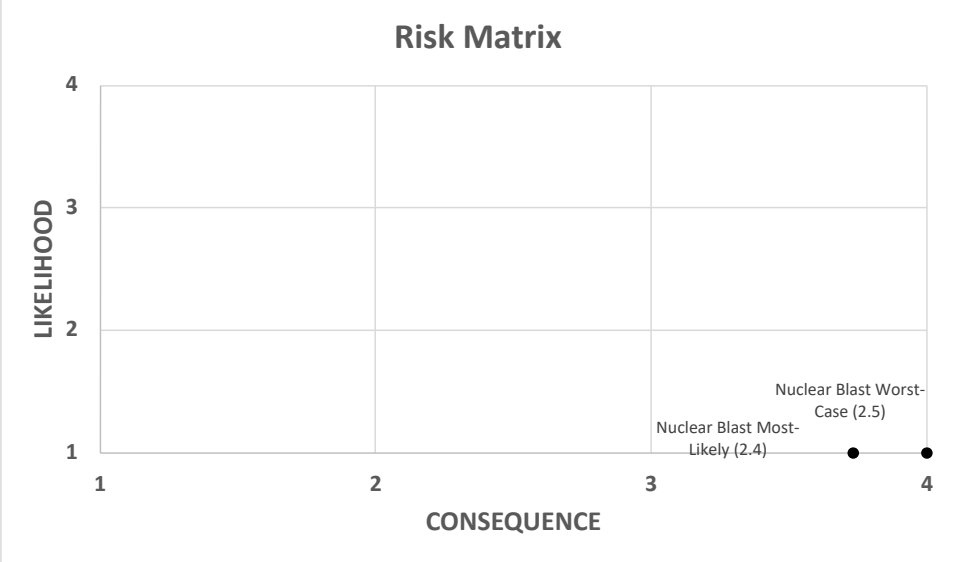
Nuclear Blast Risk Profile				
	Risk Assessment Category	**Likely Hazard Scenario**	**Worst-Case Hazard Scenario**	**Weight**
LIKELIHOOD	**Likelihood**	1 Unlikely		50%
CONSEQUENCE	**Impact**	3.7 Critical-Catastrophic	4 Catastrophic	40%
	Warning Time	4 Short	4 Short	5%
	Duration	4 Very Long	4 Very Long	5%
TOTAL RISK SCORE		**2.4**	**2.5**	

**The Likelihood Score reflects the likelihood of any emergency-level hazard event and does not differentiate between Likely and Worst-Case scenarios.*

[1] *More Information on Types of Radiation Emergencies,* CDC. Available at https://www.cdc.gov/nceh/radiation/emergencies/moretypes.htm (last accessed October 4, 2019).

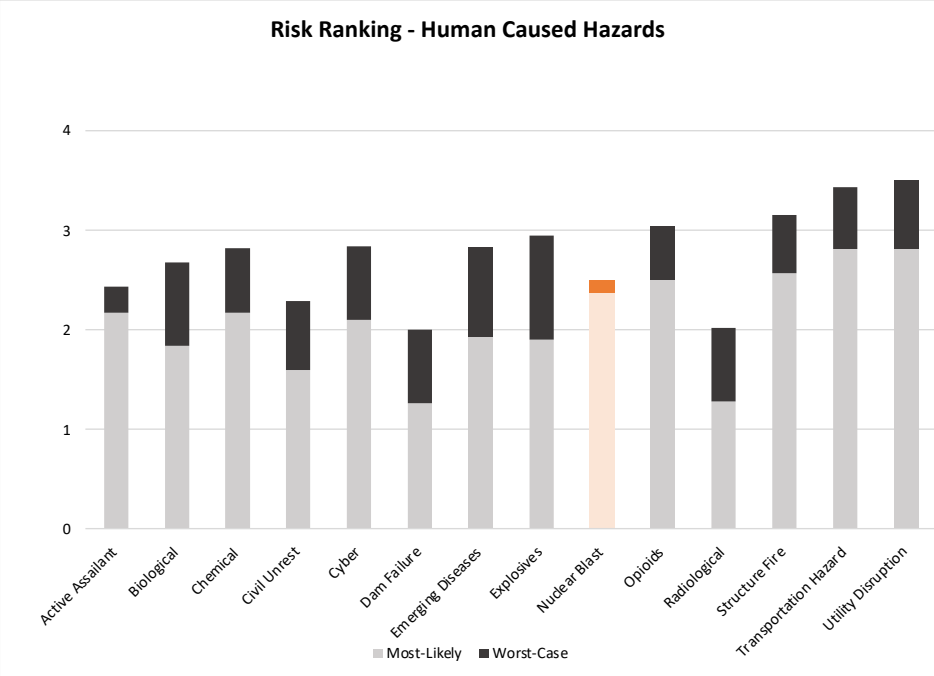
Risk Matrix

The Risk Matrix is a graphical illustration of hazard risk as a function of Likelihood and Consequence. Consequence includes the Impact, Duration, and Warning Time of the hazard.



Risk Ranking

The Risk Ranking is a graphical illustration of hazard risk as it relates to other hazards.



Where no Worst-Case bar is visible, Worst-Case Risk is equivalent to Likely Risk.

HAZARD CHARACTERISTICS

The Hazard Characteristics section provides a detailed characterization of the hazard and the local context as it relates to the hazard.

Description of the Hazard

A nuclear blast is hazardous in many distinct ways. A nuclear blast results in a large fireball that vaporizes everything within the immediate blast area and carries it upward. Light and heat radiate outward from the explosion, and an electromagnetic pulse is emitted during the first few seconds of the blast. A blast wave generates overpressure and propagates rapidly out from the epicenter. Prompt radiation levels are high near the epicenter during the first minute of the explosion but decrease rapidly with time and distance. As the debris cloud cools, dust-like particles of radioactive material are dispersed by the wind and drop back to earth as fallout.[2] It is rare to have any advanced warning of a nuclear blast that is detonated at ground level. Although there are systems in place to detect the launch of nuclear missiles, the advanced warning time may be measured in minutes rather than hours.

Explosive capacity for nuclear weapons is measured in kilotons (kt) (1kt = 1,000 tons) or megatons (Mt) (1Mt = 1,000,000 tons). This unit of measurement refers to the weight of TNT that would be required to release an equivalent level of explosive energy. The energy yield of a nuclear blast can vary greatly. The lightest tactical nuclear weapons have a yield of 0.01kt. Bombs like those dropped in World War II have a yield of 13-20kt. Modern nuclear weapons like those used by the U.S. and Russian militaries can have explosive yields of 40-50Mt.

The area affected by a nuclear blast will vary depending on the explosive yield of the bomb. A 0.1kt explosion will have a Severe Damage Zone of 200 yards, a Moderate Damage zone extending to ¼ mile, and a Light Damage Zone extending to one mile from the epicenter of the explosion. A 1kt explosion will have a Severe Damage Zone of ¼ mile, a Moderate Damage zone extending to ½ mile, and a Light Damage Zone extending to two miles from the epicenter of the explosion. An explosion greater than 10kt will have a Severe Damage Zone of at least ½ mile radius, a Moderate Damage zone extending to one-mile radius, and a Light Damage Zone extending to a three-mile radius from the epicenter of the explosion.2 The electromagnetic pulse (EMP) emitted by a Nuclear Blast can easily span hundreds of miles.

Depending on the wind and weather conditions at the site of the attack, radioactive fallout can occur many miles from the blast. The highest concentrations of radiation fall closest to the detonation site, while exposure outside of the blast radius is greatly affected by weather. Radiation dose from fallout is largely dependent on time, distance, and shielding.

[2] *Nuclear Detonation: Weapons, Improvised Nuclear Devices,* U.S. Dept. of Health and Human Services. Available at http://www.remm.nlm.gov/nuclearexplosion.htm (last accessed October 4, 2019).

The size of a nuclear blast makes it unlikely that a nuclear weapon attack could occur without directly impacting a significant percentage of the population in the region of the attack. In the case of a military or terrorist attack, the nuclear blast will likely be targeted at an urban area for maximum impact.

The onset of a nuclear blast is immediate, but effects of the blast can cause the affected area to remain hazardous for many years. Blast effects, thermal effects, and the electromagnetic pulse following a nuclear explosion are nearly instantaneous. Radioactive fallout decays rapidly in the hours following a nuclear detonation. After three hours, initial radiation exposure rates are down to 20%, exposure rates are down to 10% after 8 hours, and exposure rates fall to 1% after 48 hours. Radioactive contamination in the blast area is highly dependent on the type and yield of the nuclear explosive device. A large nuclear blast can result in radioactive contamination that remains hazardous for up to 10 years.

Local Context

The Local Context section describes community attributes that affect the likelihood of the hazard's occurrence or vulnerability to the hazard's consequences

The entire planning area is susceptible to the effects of a nuclear blast. Given the large geographic scope of a nuclear blast, an attack many miles away in Washington, D.C. or the City of Baltimore may create a catastrophic hazard within Howard County.

The location of Howard County may increase local vulnerability to a nuclear blast and other terrorism-related attacks. Howard County is in close proximity to valuable military and terrorist targets including Washington, D.C., the City of Baltimore, the Port of Baltimore, and BWI Airport. Due to its proximity to the NCR, many Federal agencies, defense contractors, and high-profile targets maintain facilities within Howard County.[3]

LIKELIHOOD ANALYSIS

The Likelihood Analysis section characterizes the historical occurrence and future likelihood of the hazard in the planning area.

Occurrence of the Hazard

The Occurrence of the Hazard section details the historical occurrence of the hazard in the planning area.

There has never been a nuclear blast in or impacting Howard County (1945-2022). Howard County is centrally located between Washington, D.C. and Baltimore, Maryland. A nuclear blast at either of these high volubility targets would be felt in Howard County.

[3] *Manmade Hazard Identification and Risk Assessment Workshop (unpublished)*, Howard County OEM (2014).

Future Likelihood Howard County – Nuclear Blast

The Future Likelihood section anticipates the future occurrence rate of the hazard based on historical likelihood and future trends. This section also addresses factors that may cause the future likelihood to deviate from historical trends.

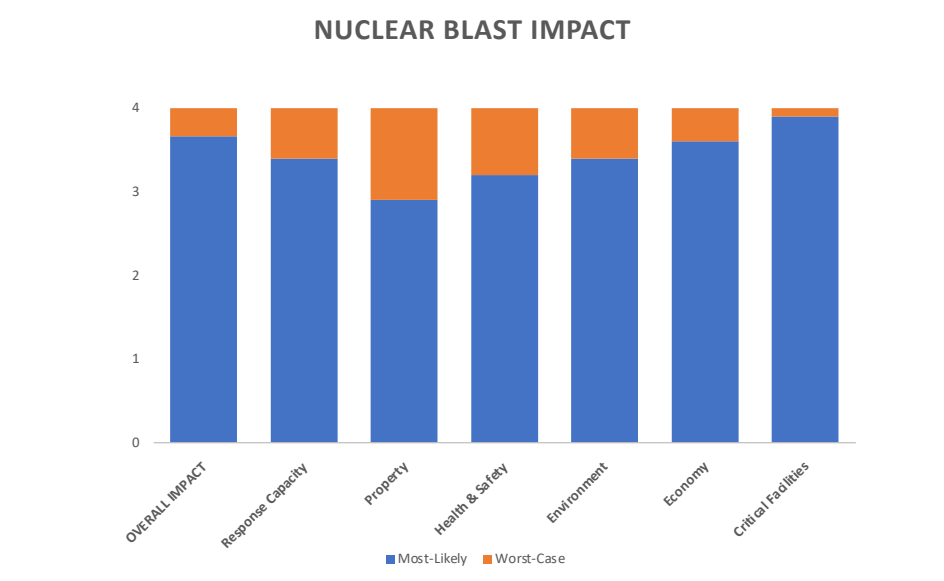
Future Likelihood of a Nuclear Blast in Howard County	
Historical Average (time period)	0 recorded events (1945-2022)
Historical Annual Probability	0% chance of annual occurrence
Future Likelihood Expected to Deviate from Historical Likelihood (Yes/No)	No
Future Annual Probability	0-1% chance of annual occurrence
Future Likelihood Score	1 (Unlikely)
Future Likelihood reflects the likelihood of any emergency-level hazard event and does not differentiate between Likely and Worst-Case scenarios.	

Considerations: The future likelihood of a nuclear blast hazard in Howard County is not expected to be significantly different from the historical occurrence rate. A future annual probability of 0-1% classifies the likelihood of a nuclear blast hazard as Unlikely, or one event every 100 years. Increases in geopolitical tensions and the proliferation of nuclear technology may result in a slight increase in likelihood over time. Other considerations include Howard County's proximity to Washington, D.C., the National Security Agency (NSA), the City of Baltimore, Peach Bottom Atomic Power Station (PBAPS) and Calvert Cliffs Nuclear Power Plant (CCNPP).

CONSEQUENCE ANALYSIS

The Consequence Analysis section provides a detailed characterization of the anticipated consequences of likely and worst-case hazard events. This section characterizes impacts to property, health and safety, critical facilities, response capacity, the environment, and the economy. This section also characterizes the public perception of each hazard, the perceived impact to personal safety and standard of living, and public confidence in response capability.

Consequence Analysis Overview



Where no Worst-Case bar is visible, Worst-Case impact is equivalent to Likely impact.

Nuclear Blast - Warning Time and Duration		
	Likely	**Worst-Case**
WARNING TIME	*Short.* No warning time likely prior to an attack. In some cases, there may be a short warning time of up to one hour.	*Short.* No warning time prior to an attack.
DURATION	*Very Long.* In the event of a nuclear blast in a neighboring region, onset of the EMP hazard is nearly instantaneous. Radioactive fallout occurs over a period of one week, and it takes months before the radioactive hazard is neutralized in Howard County. The economic impact could last decades.	*Very Long.* In the event of a nuclear blast in Howard County, onset of the hazard is nearly instantaneous. Radiation will likely persist at a hazardous level for many years. It may take up to ten years to declare the hazard location safe.

Consequence Analysis: Likely Hazard Scenario

The Consequence Analysis table details the anticipated consequences of the most likely hazard scenario.

Nuclear Blast - Consequence Analysis Likely		
CATEGORY	**RANKING**	**DESCRIPTION**
PROPERTY DAMAGE	*Significant-Critical*	▪ Major damage to critical and non-critical infrastructure. The EMP from a nuclear blast in a neighboring jurisdiction would cause significant disruption to electronics equipment in Howard County. ▪ Howard County spared from the direct effects of the fireball.
HEALTH AND SAFETY	*Critical-Catastrophic*	▪ Many deaths and injuries are likely, although the exact number is difficult to predict. ▪ In the case of a nuclear blast in a neighboring jurisdiction, deaths and injuries in Howard County would likely be due to cascading effects rather than direct effects of the attack itself. Radiation sickness may result from radioactive fallout.
CRITICAL FACILITIES	*Critical-Catastrophic*	▪ *Utilities* – Shut down for days or weeks. If employees are not able to work, drinking water and wastewater systems will shut down within one day. ▪ *Information/Communications* – Shut down for days or weeks. The EMP will cause significant damage to all electronically based systems, including phone service and internet access. ▪ *Transportation* – Extensive delays for weeks or months. Evacuation will cause severe traffic delays on nearly all transportation routes. Transportation staff will be unavailable for work for an extended period of time.
RESPONSE CAPACITY	*Critical-Catastrophic*	▪ *Police* – Mutual aid needed. Sheriff's office will be needed to support operations. ▪ *Fire and Rescue* – Significant and long-lasting need for state or federal assistance. Response capability would be severely strained even if a nuclear blast were to occur in a neighboring jurisdiction. Maintaining continuity of operations would be difficult. ▪ *Health* – Significant and long-lasting need for state or federal assistance. Nearly all HD operations will be severely affected due to shelter in place recommendations, evacuation of staff, and emergency response. ▪ *Hospitals* – Significant and long-lasting need for state or federal assistance. Significant strain on hospital capacity. The hospital will likely be completely full for up to one month with large number of psychological casualties (worried well) for months. ▪ *Emergency Management* – Significant and long-lasting need for state or federal assistance. Considerable ongoing assistance may be necessary to support emergency management in sheltering activities, evacuation planning, response coordination, and recovery planning. Loss of staff may necessitate significant assistance to support EOC operations and multi-agency coordination.
ENVIRONMENTAL IMPACT	*Critical-Catastrophic*	▪ Long term pollution and contamination. Loss of species. Renewable, but only after some time. Radioactive material would contaminate the air, water, and land for months. Radiological materials that can kill or debilitate humans may also kill or debilitate other animal life in the area. The contamination will include surface drinking water.
ECONOMIC IMPACT	*Critical-Catastrophic*	▪ Billions in lost economic output. Other costs include cleanup and healthcare for those affected. Business ceases. Job loss and recovery incalculable.
TOTAL IMPACT	***Critical - Catastrophic***	▪ **Total Impact Score: 3.7 on a scale of 1 (Limited) to 4 (Catastrophic).**
Limited	*Significant*	*Critical*	*Catastrophic*

Consequence Analysis: Worst-Case Hazard Scenario

The Consequence Analysis: Worst-Case table details the anticipated consequences of the worst-case hazard scenario that could reasonably occur within the jurisdiction.

Nuclear Blast - Consequence Analysis Worst-Case		
CATEGORY	**RANKING**	**DESCRIPTION**
PROPERTY DAMAGE	*Catastrophic*	▪ 100% damage to critical and non-critical infrastructure. Damage would come from many sources, including the nuclear fireball, blast overpressure, EMP, and prompt and delayed radiation.
HEALTH AND SAFETY	*Catastrophic*	▪ 10,000-20,000 deaths likely and 100,000+ injuries likely. Deaths and injuries will likely be the result of complete vaporization, radiation sickness, overpressure blast injuries, or trauma from structural collapse. Multiple deaths and injuries will also occur from any number of cascading effects from the overpressure blast, radioactive fallout, EMP, and mass evacuation.
CRITICAL FACILITIES	*Catastrophic*	▪ *Utilities* – Shut down for 10+ years. Total shutdown of all system will occur. Restoring service will require a complete rebuild of utilities infrastructure. ▪ *Information/Communications* – Shut down for 10+ years. Restoring service will require a complete rebuild of information and communications infrastructure. ▪ *Transportation* – Shut down for 10+ years. A large percentage of transportation infrastructure will be destroyed by the blast. Remaining routes will be shut down by mass evacuations. Damages will take more than a decade to rebuild.
RESPONSE CAPACITY	*Catastrophic*	▪ *Police* – Significant and long-lasting need for state or federal assistance. Local law-enforcement capabilities would be non-existent. ▪ *Fire and Rescue* – Significant and long-lasting need for state or federal assistance. There would be no local response capability or continuity of operations. ▪ *Health* – Significant and long-lasting need for state or federal assistance. HD operations will be completely disrupted. ▪ *Hospitals* – Significant and long-lasting need for state or federal assistance. All hospital services and facility would be unavailable. ▪ *Emergency Management* – Significant and long-lasting need for state or federal assistance. Local emergency management would be rendered completely ineffective. Surviving staff would likely evacuate with the rest of the population, and all local emergency management functions would be off-line.
ENVIRONMENTAL IMPACT	*Catastrophic*	▪ Catastrophic environmental impact. Species extinction is expected, generational birth defects are likely among surviving animal life, and the area will not be livable or renewable. The radioactive blast would damage or destroy plant and animal life within the impact zone. The radioactive material would contaminate the air, water, and land for 10 years or more. The contamination will include surface drinking water supply sources for the region and County. Agricultural land will not be usable for cropland or animal pasture. Failed sewage systems due to failed pumps or computer technology may cause contamination or sewage issues.
ECONOMIC IMPACT	*Catastrophic*	▪ $200 billion in lost economic output. Other costs include cleanup and healthcare for those affected. Significant number of jobs lost. All County and regional economic activity is gone for at least 10 years.
TOTAL IMPACT	***Catastrophic***	▪ **Total Impact Score: 4.0 on a scale of 1 (Limited) to 4 (Catastrophic).**
Limited		*Significant* / *Critical* / *Catastrophic*

Consequence Analysis: Public Perception

The Consequence Analysis: Public Perception table characterizes the public perception of each hazard. Details include public confidence in personal ability to respond to each hazard, public confidence in Howard County's ability to respond to each hazard, and each hazard's perceived impact to personal safety and standard of living.

Nuclear Blast - Public Perception

Perceived confidence in Howard County's ability to respond and recover from this hazard	*Perceived confidence in their personal ability to protect self and family from this hazard*	*Concern over the impact to personal health and safety if this hazard were to occur locally*	*Concern over the impact to personal standard of living or quality of life if this hazard were to occur locally*